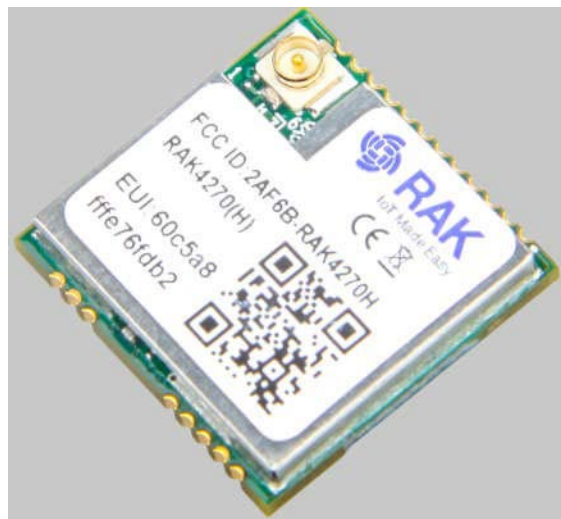Specification for

RAK4270 LoRa Module

WisDuo-LoRa Series

Version V1.2 | Apr2020

www.RAKwireless.com

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Table of Contents

1. General Overview

Introduction

The RAK4270 LoRa Module includes a STM32L071 MCU and a SX1262 LoRa chip, which supports 8 spreading factors (SF5 ~ SF12) and signal bandwidth that can be adjusted between 7.8 kHz to 500 kHz.

The module complies with the LoRaWAN 1.0.2 protocol, so it can be used for implementing LoRa networks or Lora point to point communications. The module is suitable for various applications that require long range data acquisition and low power consumption, such as: smart meters, supply chain and logistics tracking, agricultural sensors, smart cities, etc

This module is expected to be controlled by an external controller through its UART interface by sending a set of AT commands. These AT commands control not only the state of this module but also set the LoRaWan communication parameters and payloads *(see RAK AT Command Manual)*.

Main Features

- LoRa module is suitable for applications in Smart City, Smart Agriculture, Smart Industry.

- Compact form factor: 15 x 15.5 x 2.5 mm (LxWxH).

- 20 pin stamp pad for PCB SMT board-to-board soldering.

- I/O ports: UART/I2C/GPIO.

- AT commands control interface

- Temperature range: -40°C to +85°C

- Supply voltage: 2.0 to 3.6V

- Frequency Bands 433MHz(EU)/ 470-510MHz(CN)/ 865-867MHz(IN)/ 863–870MHz (EU)/ 500kHz: 903–914.2MHz,125kHz:902.3-914.9MHz(US)/915-928MHz(AU)/ 920-923MHz(KR) / 920- 923MHz(AS)

- LoRa bandwidth range of 7.8 kHz to 500 kHz, SF5 to SF12, BR=0.018~62.5 kb/s

- Ultra-low power Consumption: 1.5uA in sleep mode

- Arm Cortex-M0+ 32-bit RISC core.

- 128 kbytes flash memory with ECC

- 20 kbytes RAM

- 6 kbytes of data EEPROM with ECC

- Compliance with [TBC][add regulations here]

2. RAK4270 LoRa Module

Device Overview

Figure 1 shows the top view of the RAK4270 LoRa module. The dimensions of the module are 15 x 15.5 x 2.5 mm.

Figure 1 | RAK4270 LoRa module

Supported LoRaWAN bands

The RAK4270 LoRa module supports the high LoRaWAN bands (refer to the Table 1)

Module	Region	Frequency (MHz)
RAK4270(L)	**Europe**	EU433
	China	CN470
RAK4270(H)	**Indian**	IN865
	Europe	EU868
	North America	US915
	Australia	AU915
	Korea	KR920
	Asia	AS923

Table 1 | Operating Frequencies

Pin Definition & Pin Out

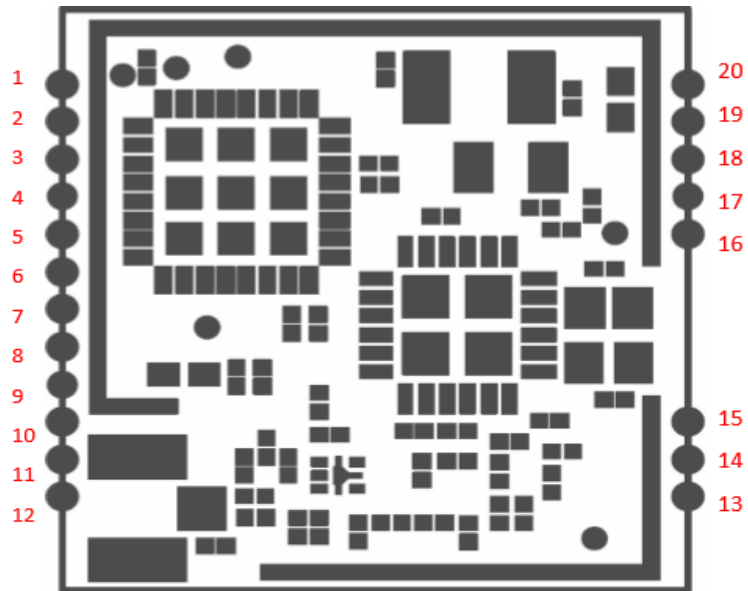The Figure 3 shows the pinout of the RAK4270 LoRa module.

Figure 2 | Pinout

The table below shows the pin definition of the RAK4270 LoRa Module.

Pin	Name	I/O	Description	Alternate functions
1	UART2_RX	I	This UART port is used as an AT command port (STM32L071KBU6 PA3)	USART1_RX, I2C1_SDA
2	UART2_TX	O	This UART port is used as an AT command port (STM32L071KBU6 PA2)	MCO, USART1_TX, I2C1_SCL, I2C3_SMBA
3	UART2_DE	I/O	GPIO (STM32L071KBU6 PA1)	SPI1_MOSI,EVENTOUT, USART1_RTS_DE, COMP2_OUT
4	UART1_TX	I/O	This UART port can be used as an AT command port and an upgrade port (STM32L071KBU6 PA9)	TIM21_CH1,TIM2_CH3, USART2_TX,LPUART1_TX, COMP2_OUT,COMP2_INM, ADC_IN2
5	UART1_RX	I/O	This UART port can be used as an AT command port and an upgrade port (STM32L071KBU6 PA10)	TIM21_CH2,TIM2_CH4, USART2_RX,LPUART1_RX, COMP2_INP,ADC_IN3
6	UART1_DE	I/O	General GPIO or UART(Reserved) (STM32L071KBU6 PA12)	EVENTOUT,TIM2_CH2,USART2_RTS_DE, TIM21_ETR, USART4_RX,COMP1_INP, ADC_IN1
7	SWDIO	I/O	Programming (STM32L071KBU6 PA13)	SWDIO, LPUART1_RX
8	SWCLK	I/O	Programming (STM32L071KBU6 PA14)	SWCLK, USART2_TX, LPUART1_TX
9	I2C_SCL	I/O	I2C interface (STM32L071KBU6 PB6)	USART1_TX,I2C1_SCL, LPTIM1_ETR,COMP2_INP
10	I2C_SDA	I/O	I2C interface (STM32L071KBU6 PB7)	USART1_RX,I2C1_SDA, LPTIM1_IN2,USART4_CTS, COMP2_INP,VREF_PVD_IN
11	GND	-	Ground	-
12	RF	I/O	RF port (reserved), default RF out by IPEX	-
13	GND	-	Ground	-
14	GND	-	Ground	-
15	ANT_SW	I/O	PA11	leave it un-connect on mainboard
16	PB4	I/O	STM32L071KBU6 PB4	USART1_CTS,SPI1_MISO, TIM3_CH1,I2C3_SDA

17	PA8	I/O	STM32L071KBU6 PA8	USART1_CK,I2C3_SCL, MCO,EVENTOUT
18	MCU_NRST	I/O	MCU reset (STM32L071KBU6 NRST)	-
19	GND	-	Ground	Ground
20	VDD	-	DC3V3	Supply voltage 2.0~3.3V

Table 2 | Pin Definitions

Power Consumption

Frequency	Output Power
125kHz: 902.3-914.9MHZ	10.19dBm
500kHz: 903.0-914.2MHZ	11.41dBm

Recommended Circuit

SWD programming Port

In order to upgrade the firmware, the SWD (Serial Wire Debug) interface must be used. A 5 pin JLINK cable has to be connected to the SWD port. These pins are: 3v3, SWDIO, SWCLK, and MCU_NRST.

UART ports

There are two UART ports on RAK4270 module. UART2 (pin1 and pin2) can be used as the command port, while the UART1 (pin4 and pin5) can be used both as command port and firmware upgrade port. It is recommended to connect the UART2 port to an external MCU and reserve UART1 for debugging and or future firmware upgrade purposes.

The serial communication parameters to connect to the UART2 port are: 115200 / 8-N-1.

I2C port

The RAK4270 exposes a I2C port, in which the SDA line is assigned to the pin9, and SCL line is assigned to pin10. This I2C port allows to control additional slave sensors with the RAK4270 using I2C protocol. The RAK4270 will be the master. If the I2C port is used, then external pull-up resistors mus added to the SDA and SCL lines. The recommended value of the resistors are 10 kOhm.

RF port

The RAK4270 module expose two types of RF antenna: IPEX and PAD. The most straightforward way is to use the IPEX antenna port. In such case, you just to connect the antenna to the IPEX connector on the module directly. In the other hand, for specific needs, customers can design a PCB trace antenna, Chip antenna, SMA antenna, or spring type antenna. In the latter case, the customer should use the PAD type antenna port expose by this module. The external antenna should be matched to the 50 Ohm RF transmission line.

VDD power in

It is recommended to add 4 decoupling capacitors near the module at the entrance of the power supply pin. The recommended values of the capacitor are C1 =10uF, C2=10uF, C3=100nF, C4=100nF.

Mechanical Dimensions

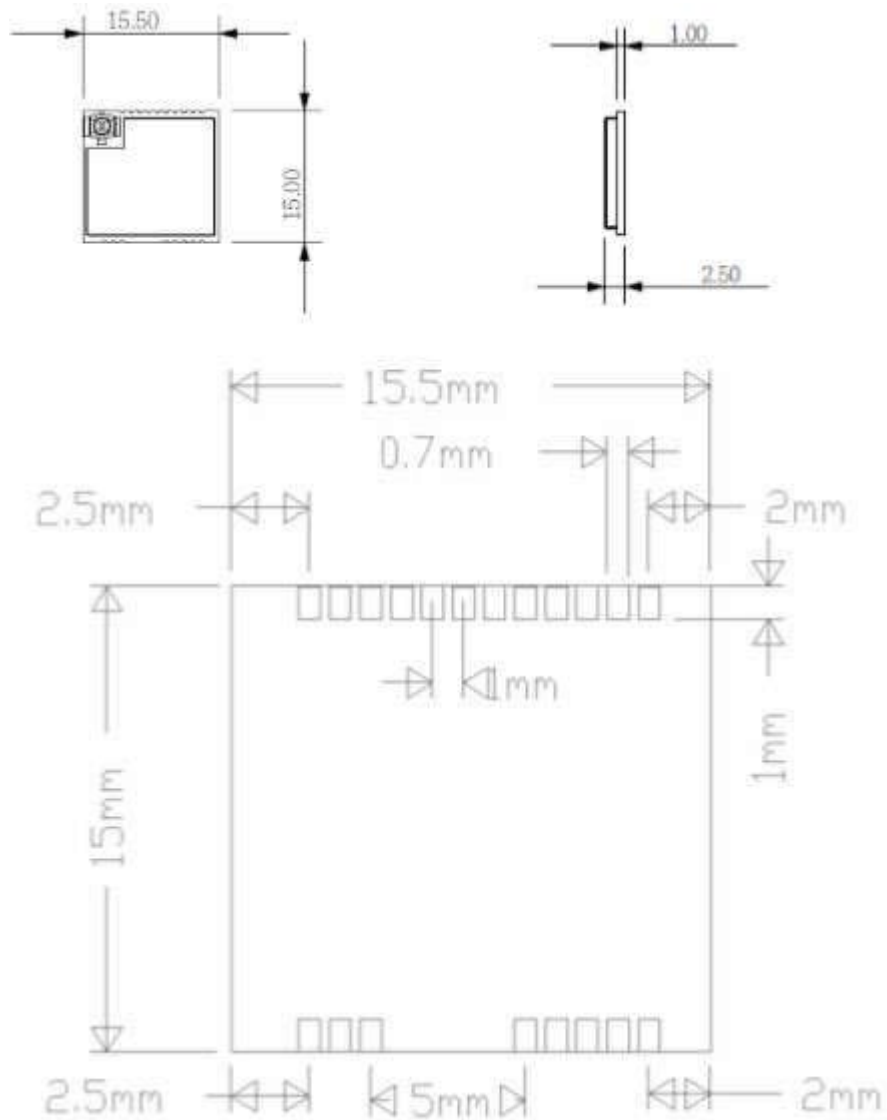The Figure 8 shows the mechanical dimension of the RAK4270 LoRa module.

Figure 3 | *Mechanical Dimensions*
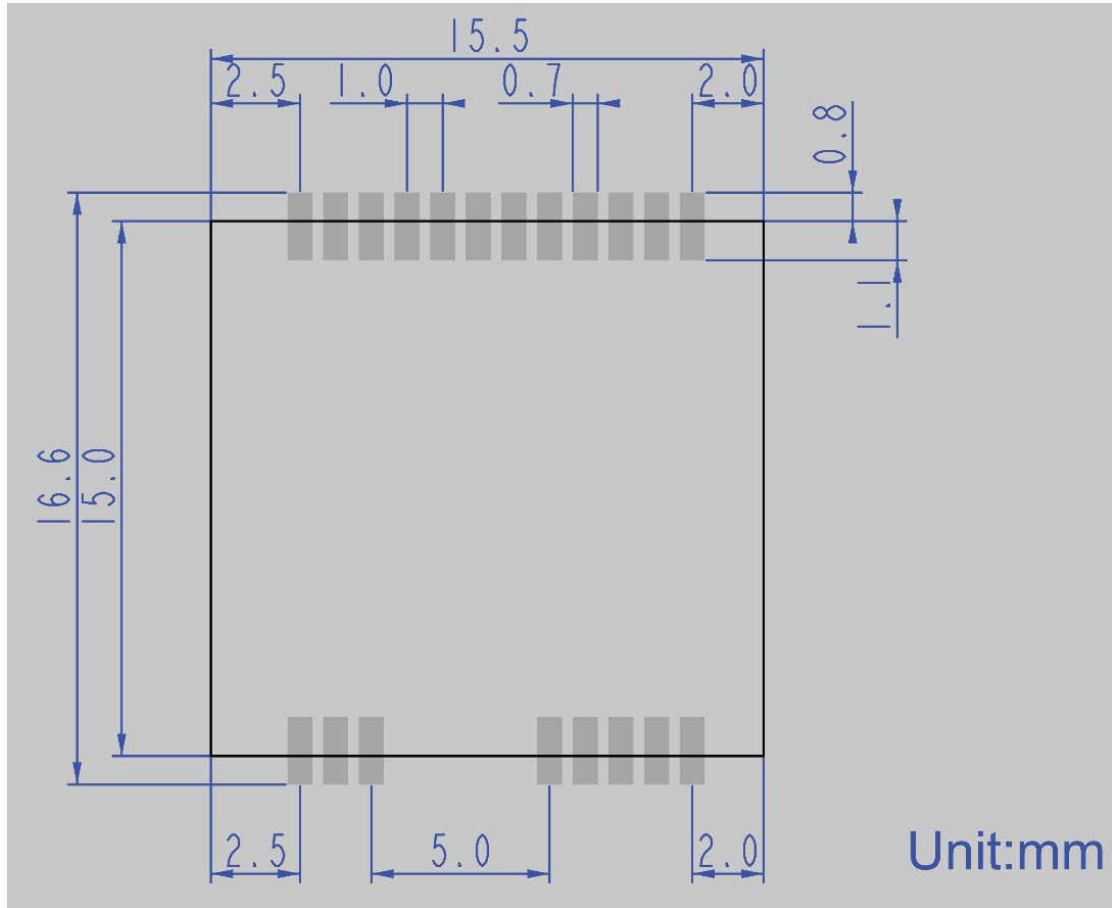
Recommended Footprint

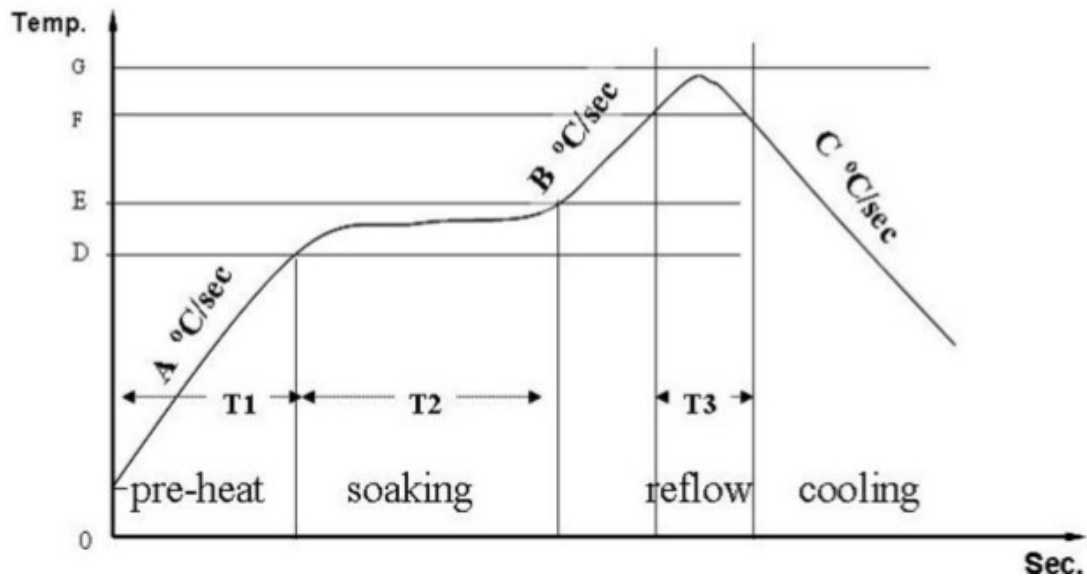*Figure 4 | Recommended PCBfootprint*

Recommended Reflow Profile

Figure 5 | Recommended ReflowProfile

Standard conditions for reflow soldering:

- Pre-heating Ramp (A) (Initial temperature: 150℃): 1~2.5℃/sec;

- Soaking Time (T2) (150℃~180℃): 60sec~100sec;

- Peak Temperature (G): 230~250℃;

- Reflow Time (T3) (>220℃): 30~60 sec;

- Ramp-up Rate (B): 0~2.5℃/ sec;

- Ramp-down Rate (C): 1~3℃/ sec.

Customer Support

Please contact us if you need technical support or need more information.

Support center: https://forum.rakwireless.com/

Email us: info@rakwireless.com

3. Revision History

Revision	Description	Date
1.0	Initial version	2020-04-02
1.1	First review	2020-04-07

4. Document Summary

Prepared by	Checked by	Approved by
Hairui	Penn & Vladislav	

INTEGRATION INSTRUCTIONS
1. This module has been tested and found to comply with the FCC Part15.247 for Modular Approval.

2. This Modular Approval is limited to OEM installation for mobile and fixed applications only. The antenna installation and operating configurations of this transmitter, including any applicable source-based time- averaging duty factor, antenna gain and cable loss must satisfy MPE categorical Exclusion Requirements of 2.1091. This modular should be installed and operated with minimum distance 20 cm between the radiator& your body.

3. The U.FL connector antenna has been approved for the modular. The maximum antenna gain are 2.3dBi (White Antenna)& 2.0dBi (Black Antenna). For situations where the host manufacturer is responsible for an external connector, the integration instructions shall inform the installer that a unique antenna connector must be used on the Part 15 authorized transmitters used in the host product.

4. When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily removed. If not, a second label must be placed on the outside of the final device that contains the following text: －Contains FCC ID: 2AF6B-RAK4270H.

5. The Shenzhen Rakwireless Technology Co., Ltd. uses various test mode programs for test set up which operate separate from production firmware. Host integrators should contact Shenzhen Rakwireless Technology Co., Ltd. for assistance with test modes needed for module/host compliance test requirements.

6. The Shenzhen Rakwireless Technology Co., Ltd. modular transmitter is only FCC authorized for the FCC Part15.247 listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.